



By

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FOR

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PART 1: INTRODUCTION TO COMPUTER GRAPHICS:

1. Suppose an RGB raster system is to be designed using an 8 inches by 10 inches screen

With a resolution of 100 pixels per inch in each direction. If we want to store 6 bits per pixel in the frame buffer, how much storage do we need for the frame buffer?

The size of frame buffer is (8 x 10 x 100 x 100 x 6)/ 8= 600000 bytes

2. How long will it take to load a 640 by 480 frame buffer with 12 bits per pixel, if 10^5 bits can be transferred per second? How long will it take to load a 24 bit per pixel frame buffer with a resolution of 1280 by 1024 using this same transfer rate?

Let X the time that will be taken to load a 640-by-480 frame buffer with 12 bits per pixel.

Number of bits = 640 * 480 * 12 = 3686400 bits

1 sec 10^5 bits and X sec(s)   3686400 bits

Then X = 3686400/105 = 36.864 second

Let X the time that will be taken to load a 1280 by 1024 frame buffer with 24 bits per pixel. Number of bits = 1280 * 1024 * 24= 31457280 bits

1 sec 10^5 bits and X sec(s)   31457280 bits

Then X = 31457280/ 105 = 314.5728 second

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3. We have a computer with 32 bits per word and transfer rate of 1 maps (million instructions per second). How long will it take to fill frame buffer of 300 dpi per inch laser printer with page size of 8.5 inches by 11 inches?

32 bit * 1 million

300 * 11 * 8.5 * 300 * 8,41,500

Number of dots for the frame

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4. Consider two raster systems with resolution of 640 by 480 and 1280 by 1024.

- How many pixels could be accessed per second in each of these systems by a display controller that refreshes the screen at a rate of 60 frames per second?

- What is the access time per pixel in each system?

The first system:

No of pixel could be accessed per sec =

No of frame parsec * No of pixel in the frame

= 60 * (640 * 480) = 18432000 pixels

Assume X access time per pixel

Number of bits = 640 * 480 * 12 = 3686400 bits

1 sec 18432000 pixels

X sec 1 pixel

$X = 1 / 18432000 = 5.43*10^{-8}$ sec

The second system:

No of pixel = 60 * (1280 * 1024) = 78643200 pixels

1 sec 78643200 pixels

X sec 1 pixel

$X = 1 / 78643200 = 1.27*10^{-8}$ sec

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5. Suppose we have a video monitor with a display area that measures 12 inches across and 9.6 inches high. If the resolution is 1280 by 1024 and the aspect ratio is 1, what is the dimensions of the each screen point?

1280 pixel wide = 12 inches

1024 pixel wide = 9.6 inches

1280 / 1024 = 12 / 9.6 = aspect of raho of 1

(so the width should be = height)

Pixel width = 12 / 1280 = 0.009375 inches

Pixel height = 9.6 / 1024 = 0.009375 inches

6. How much time is spent scanning across each row of pixels during screen refresh on a raster system with a resolution of 1280 by 1024 and a refresh rate of 60 frames per second.

The time req for scanning one frame

= 1 / 60 sec

One frame has 1024 rows

The time of scanning of one row is

= 1 / 60 / 1024 = $1.6 * 10^{-5}$ sec

PART 2: GRAPHICS PRIMITIVES:

A .Line Drawing Algorithm:

7. Digitize a line from point (-1,-1) to point (4, 5) using:

- Brute force line generation algorithm.
- Brenham's line generation algorithm.

Brute force line :

(-1 , -1) from to (4 , 5)

$Y = m X + c$

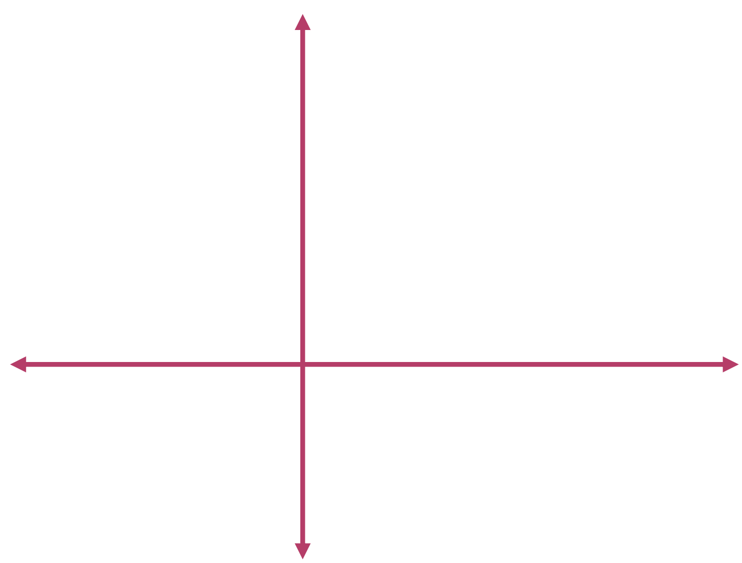
m = / = /

c =

m = -1 – 5 / -1 – 4 = 1.2

c = -1 + (1.2) = 0.2

y = 1.2 X + 0.2



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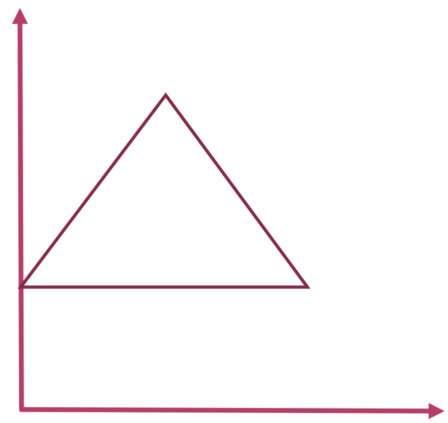
Brenham's line:

(- 1 , 1) frame to (4 , 5)

K	P_K	X_{K+1} , Y_{K+1}
0	7	
1	5	
2	3	
3	1	
4	-1	
5	3	
6	1	

8. Use the Brenham's algorithm:

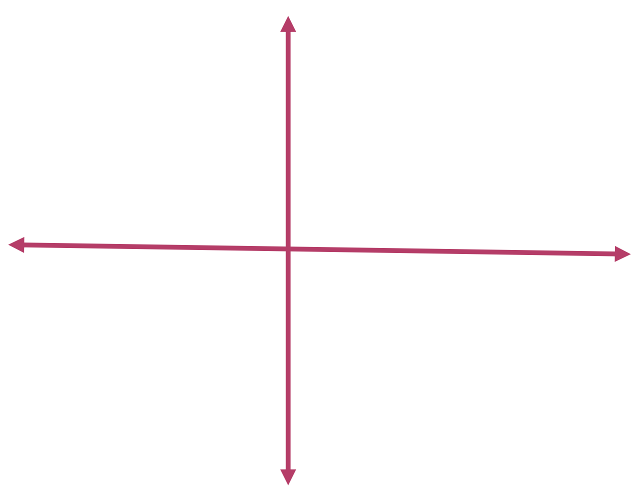
- Find all points on a triangle with vertices at **(0, 2), (6, 2) and (3, 6)**.
- Draw a line from (4, 4) and end point is (-3, 0).
- Digitize a line with end points (20, 10) and (30, 18).



K	P_K	X_{K+1} , Y_{K+1}
0		
1		
2		
3		
4		
5		

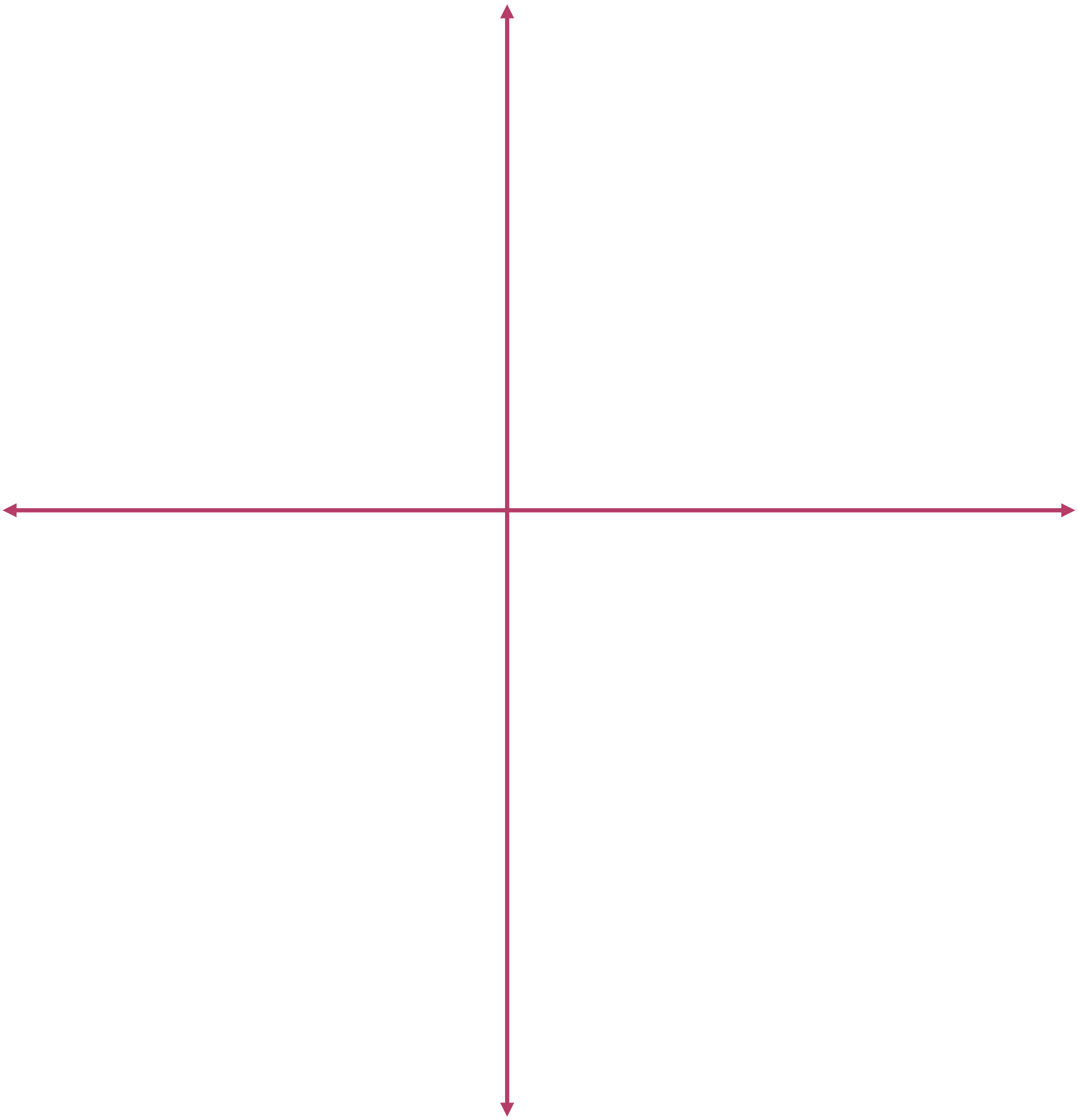
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K	P_K	X_{K+1} , Y_{K+1}
0		
1		
2		
3		
4		
5		
6		



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K	P_K	X_{K+1} , Y_{K+1}
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		



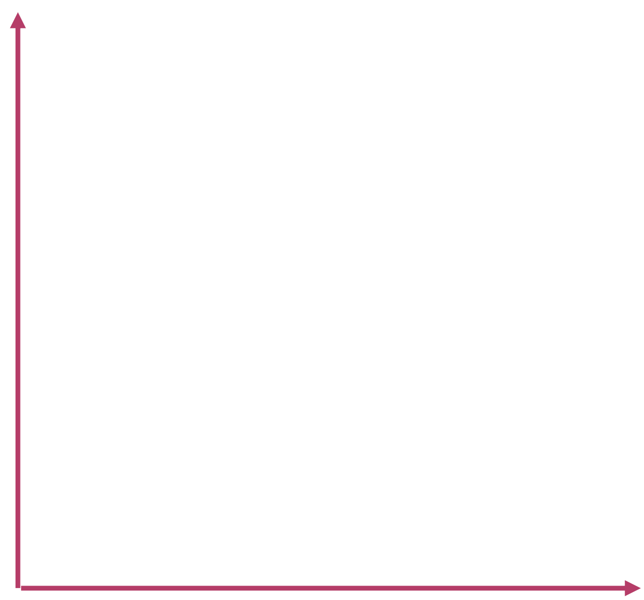
9. Using the DDA line drawing algorithm:

- 9. Find out the points that will be plotted by drawing a line (7, 5) to (13, 9).
- Digitize the line from (0, 0) to (6, 7).
- Find all points on a triangle with vertices at (0, 2), (6, 2) And (3, 6).

X	Y	X PLOT	Y PLOT
7			
8			
9			
10			
11			
12			
13			



X	Y	X PLOT	Y PLOT
0			
0.8			
1.6			
2.4			
3.2			
4			
4.8			
5.6			



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B .Circle Algorithm

10. Plot a circle at origin having center as (0, 0) and

radius=4 using the equation: $X^2+Y^2= R^2$.

1- START

2- Get the value of the center (X_2 , Y_2)

And radius (R) of circle

3- find the polar co-ordinates by :

4- $X = X_c + R \cos$

5- $Y = Y_c + R \sin$

6- plot the point (X , Y) corresponding to the

value of where lies bet and 360

7- stop

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11. Plot a circle at origin having center as (5, 5) and radius=3 using the equation:

$(X-a)^2 + (Y-b)^2 = R^2$.

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PART 3: 2D TRANSFORMATION:

12. A 2D geometric shape is rotated about a point with coordinates (1, 2) by 90°. Then, the shape is scaled about the same point
In the x-coordinate by 2 times and
In the y-coordinate by 3 times.
Finally, the shape is reflected about the origin.
Derive the single combined transformation matrix for these operations.

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13. Consider a triangle whose vertices are (2 2), (4 2)
And (4 4).

- Find the concatenated transformation matrix
  For rotation of 90 about the origin
  Followed by reflection through the line x = 0.

- b. Comment on the sequence of transformations.

- C. plot the original and resultant triangles

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14. Using the homogeneous matrices perform on the following point P (2, 2) the Following transformation in sequence: Translation (dx = 1, dy = 3) and scaling (Sx = 0, 5, Sy = 0.5).

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15. Translate a triangle with vertices at original

coordinates (10, 20), (10, 10), (20, 10) by
tx = 5, ty = 10.
plot the original and resultant triangles.

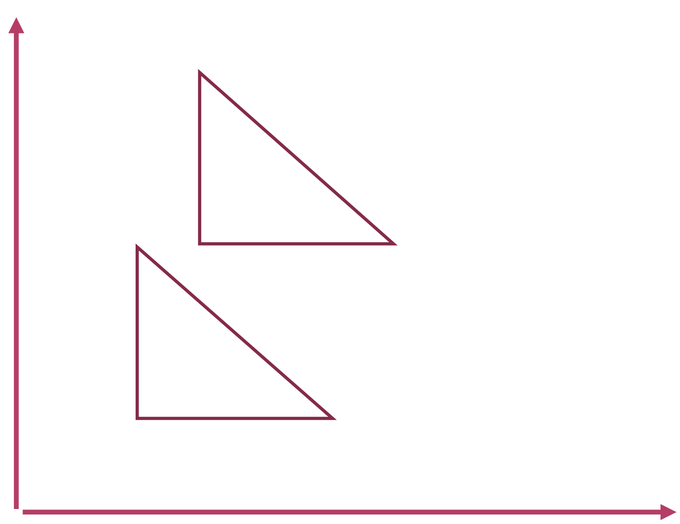
T =

P = T + P

$P_1 = T + P_1$

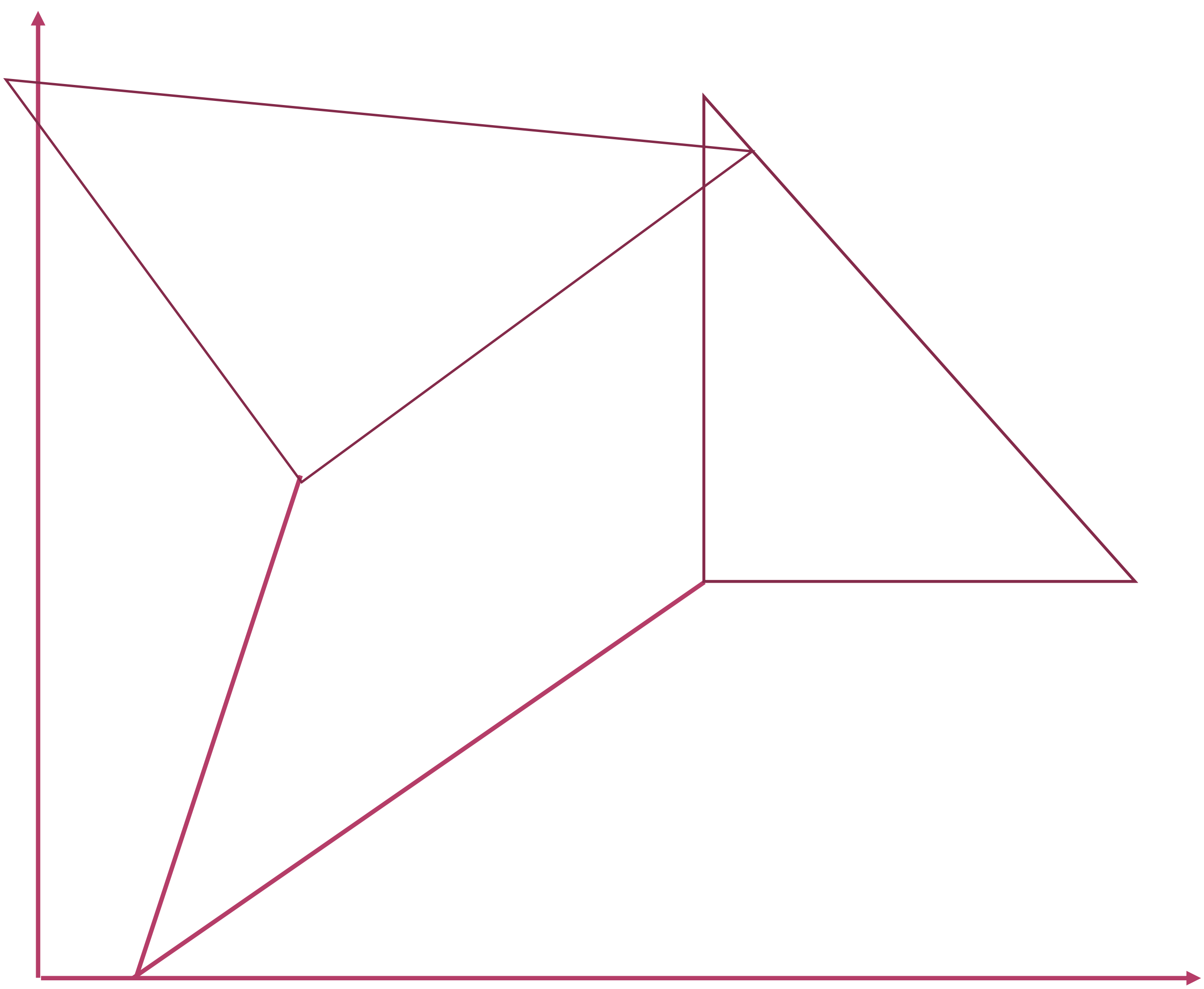
$P_2 = T + P_2$

$P_3 = T + P_3$



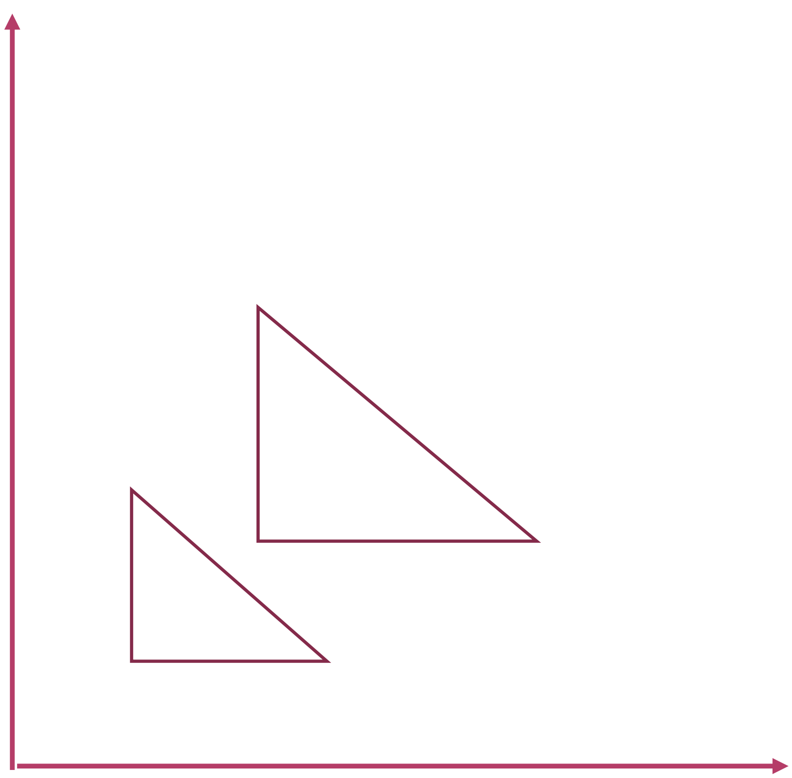
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16. Rotate a triangle about the origin with vertices at original coordinates (10, 20), (10, 10), (20, 10)
by 30 degrees,
And plot the original and resultant triangles.



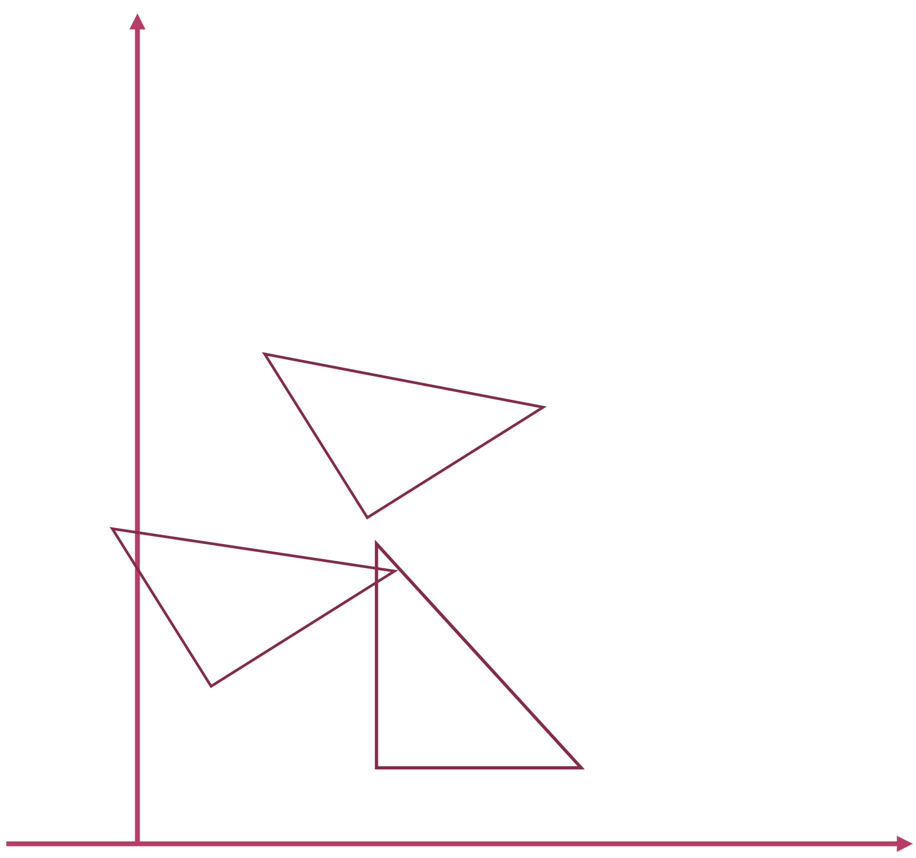
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17. Scale a triangle with respect to the origin, with vertices at original coordinates (10, 20),
(10, 10), (20, 10) by sx = 2, sy = 1.5. Roughly plot the original and resultant triangles.



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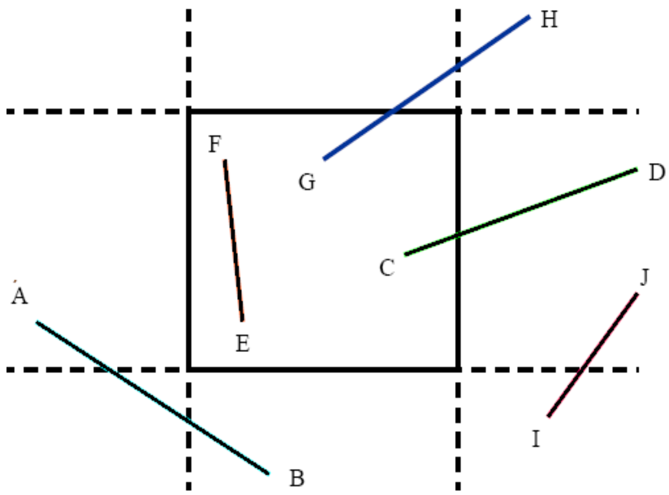
18. Rotate a triangle with vertices (10, 20), (10, 10), (20, 10) about the origin by 30 Degrees and then translate it by TX = 5 , TY = 10.

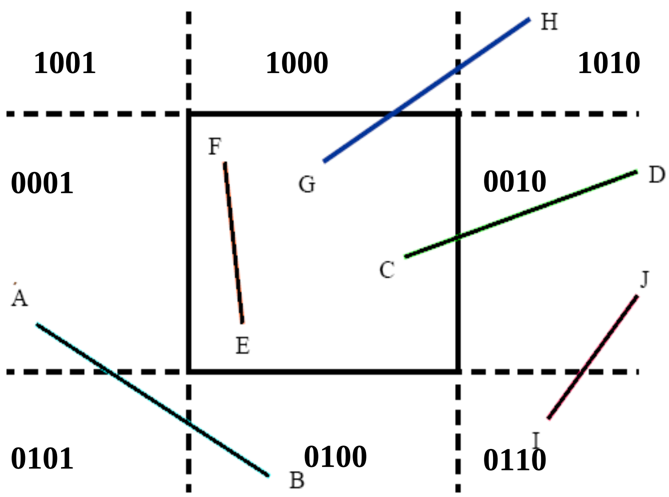


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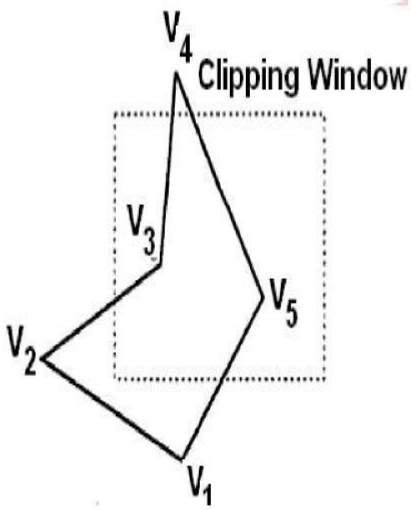
PART 4: VIEWING AND CLIPPING:

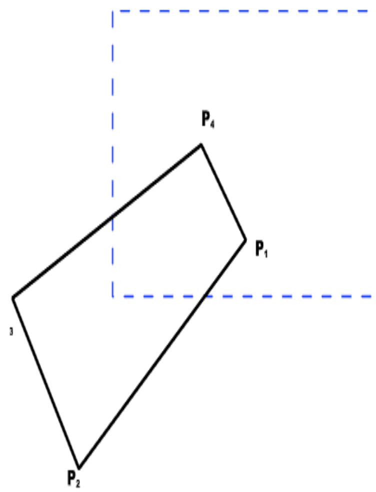
19. Apply the cohen-sutherland to perform the line clipping on the figure?

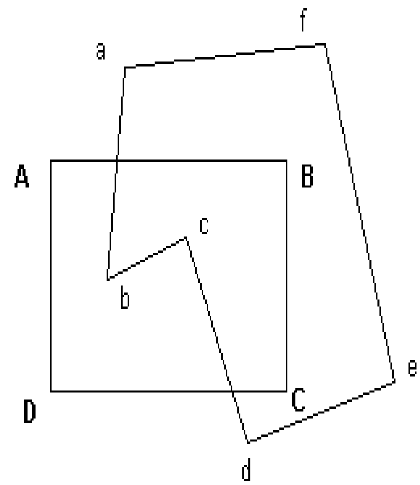




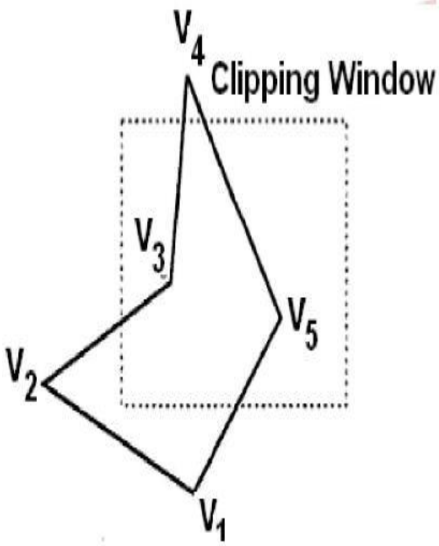
20. For the polygon and the clipping window shown in figure, give a list of vertices after each boundary clipping.

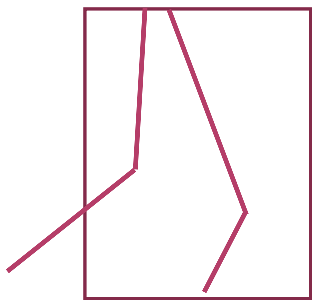


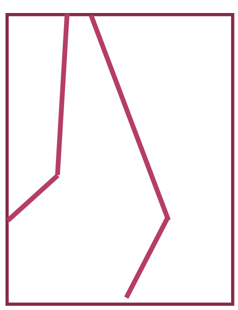


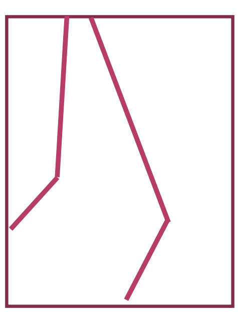


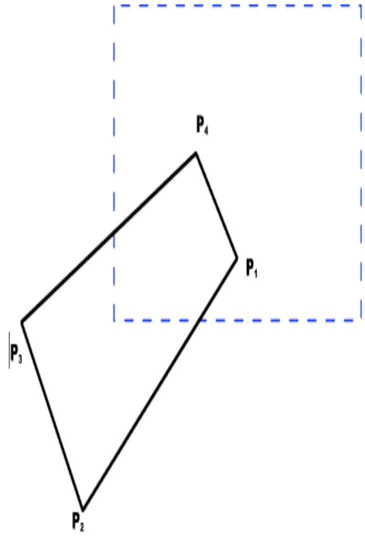
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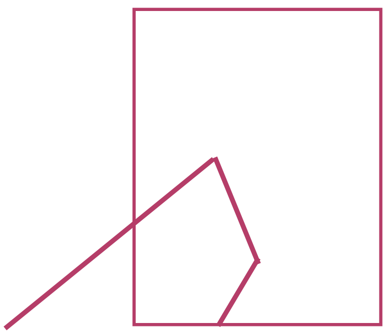

V4
Clipping Window
V3
V5
V2
V1

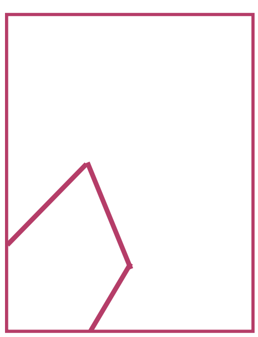


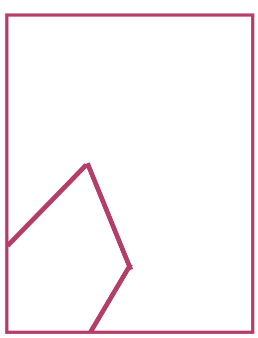


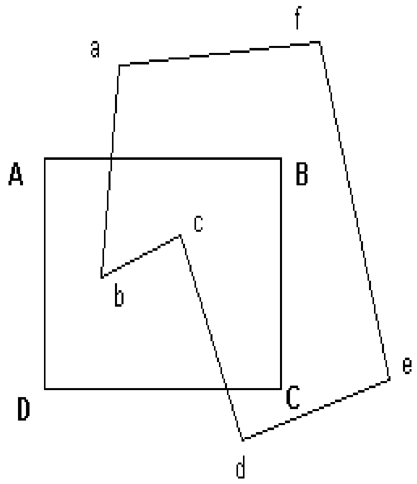



P4
P1
P3
P2








f
a
A
B
c
b
e
D
C
d





